INTERNATIONAL TELECOMMUNICATION UNION

**WRC-2000** WORLD RADIOCOMMUNICATION CONFERENCE

**Addendum 6 to Document 12-E 17 April 2000 Original: English**

ISTANBUL, 8 MAY – 2 JUNE 2000

**PLENARY MEETING**

# United States of America

## PROPOSALS FOR THE WORK OF THE CONFERENCE

**Agenda item 1.6.1 - review of spectrum and regulatory issues for advanced mobile applications in the context of IMT-2000, noting that there is an urgent need to provide more spectrum for the terrestrial component of such applications and that priority should be given to terrestrial mobile spectrum needs, and adjustments to the Table of Frequency Allocations as necessary**

**Use of high altitude platform stations in IMT-2000 terrestrial systems**

**Background information**

This proposal addresses the option to use the high altitude platform stations (HAPS) for the delivery of terrestrial IMT-2000 within the bands that WARC-92 identified for terrestrial IMT-2000 in S5.388, subject to licensing, technical, sharing, coordination and implementation regulation by administrations. It addresses regulatory issues relating to HAPS in the context of IMT-2000 and is not related to the issue of providing more spectrum for the terrestrial component of IMT-2000.

A high altitude platform station (HAPS) is defined in S1.66A as "A station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth". Each HAPS deploys a multibeam antenna capable of projecting numerous spot beams within its coverage area. The Radio Regulations, under S4.15A, state, "Transmissions to or from high altitude platform stations shall be limited to bands specifically identified in Article S5". The only bands currently identified for use by HAPS in Article S5 are in footnote S5.552A that states that "The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz is designated for use by high altitude platform stations. The use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz is subject to the provisions in Resolution 122 (WRC-97)".

ITU-R TG 8/1 completed extensive studies regarding the ability of HAPS to provide IMT-2000 services within Regions 1 and 3 using the bands 1 885-2 025 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz and within Region 2 using the bands 1 885-1 980 MHz and 2 110-2 160 MHz identified for advanced communications applications, including IMT-2000. These studies address, among other things, the ability of HAPS to coordinate and share with IMT-2000 stations operating in neighbouring administrations and with certain stations operating in other services in adjacent bands. Draft new Recommendation ITU-R M.[8/115], as approved by ITU-R Study Group 8 for adoption by correspondence, considers certain sharing and coordination requirements associated with the use of HAPS as a base station within a terrestrial IMT-2000 system. The proposed

Resolution HAPS (WRC-2000) provides minimum performance characteristics from draft new Recommendation ITU-R M.[8/115].

This proposal recognizes that in accordance with footnote MOD S5.388 and Resolution IMT (WRC-2000), administrations may use the bands identified for IMT-2000, including the bands noted herein, for stations of other primary services to which they were allocated.

As with all other types of base stations operating as a base station in an IMT-2000 system, the proposal also recognizes the need for additional future studies on the compatibility of HAPS operating as a base station in an IMT-2000 system and other stations operating in the same and adjacent frequency bands.

This proposal calls for a footnote in Article S5 of the Radio Regulations identifying HAPS as an optional method for the delivery within an IMT-2000 system in the frequency bands identified for Regions 1 and 3, the bands 1 885-2 025 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz and for Region 2, the bands 1 885-1 980 MHz and 2 110-2 160 MHz, identified for advanced communications applications, including IMT-2000, subject to Resolution HAPS (WRC-2000), Resolution IMT (WRC-2000) and national regulations.

Concerning the optional implementation of HAPS in an IMT-2000 system, the following regulatory changes are proposed:

**MOD** USA/12/160

**1 710-2 170 MHz**

| **Allocation to services** | | |
|---|---|---|
| **Region 1** | **Region 2** | **Region 3** |
| **1 710-1 930** | FIXED<br>MOBILE S5.380<br>S5.149 S5.341 S5.385 S5.386 S5.387 S5.388 ADD S5.BBB | |
| **1 930-1 970**<br>FIXED<br>MOBILE<br><br>S5.388 ADD S5.BBB | **1 930-1 970**<br>FIXED<br>MOBILE<br>Mobile-satellite (Earth-to-space)<br>S5.388 ADD S5.BBB | **1 930-1 970**<br>FIXED<br>MOBILE<br><br>S5.388 ADD S5.BBB |
| **1 970-1 980** | FIXED<br>MOBILE<br>S5.388 ADD S5.BBB | |
| **1 980-2 010** | FIXED<br>MOBILE<br>MOBILE-SATELLITE (Earth-to-space)<br>S5.388 S5.389A S5.389B S5.389F | |
| **2 010-2 025**<br>FIXED<br>MOBILE<br><br><br>S5.388 ADD S5.BBB | **2 010-2 025**<br>FIXED<br>MOBILE<br>MOBILE-SATELLITE<br>(Earth-to-space)<br>S5.388 S5.389C S5.389D<br>S5.389E S5.390 | **2 010-2 025**<br>FIXED<br>MOBILE<br><br><br>S5.388 ADD S5.BBB |

| | | |
|---|---|---|
| **2 025-2 110** | SPACE OPERATION (Earth-to-space) (space-to-space)<br>EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space)<br>FIXED<br>MOBILE S5.391<br>SPACE RESEARCH (Earth-to-space) (space-to-space)<br>S5.392 | |
| **2 110-2 120** | FIXED<br>MOBILE<br>SPACE RESEARCH (deep space) (Earth-to-space)<br>S5.388 ADD S5.BBB | |
| **2 120-2 160**<br>FIXED<br>MOBILE<br><br>S5.388 ADD S5.BBB | **2 120-2 160**<br>FIXED<br>MOBILE<br>Mobile-satellite (space-to-Earth)<br>S5.388 | **2 120-2 160**<br>FIXED<br>MOBILE<br><br>S5.388 ADD S5.BBB |
| **2 160-2 170**<br>FIXED<br>MOBILE<br><br><br>S5.388 S5.392A ADD S5.BBB | **2 160-2 170**<br>FIXED<br>MOBILE<br>MOBILE-SATELLITE (space-to-Earth)<br>S5.388 S5.389C S5.389D<br>S5.389E S5.390 | **2 160-2 170**<br>FIXED<br>MOBILE<br><br><br>S5.388 ADD S5.BBB |

**ADD** USA/12/161

**S5.BBB** In Regions 1 and 3, the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz, and in Region 2, the bands 1 885-1 980 MHz and 2 110-2 160 MHz, may be used by high altitude platform stations as base stations within an IMT-2000 system in accordance with Recommendation ITU-R IMT.RSPC, Resolution **HAPS (WRC-2000)** and Resolution **IMT (WRC-2000)**. These bands are allocated to the fixed, mobile and the mobile-satellite services, and the use by IMT-2000 applications using high altitude platform stations as an IMT-2000 base station in these bands is based on the equality of rights between all allocated radio services and does not establish priority of assignments in these bands among stations of the primary services to which they are allocated.

**ADD** USA/12/162

# DRAFT RESOLUTION HAPS (WRC-2000)

## Use of high altitude platform stations providing IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2

The World Radiocommunication Conference (Istanbul, 2000),

*considering*

*a)* that WARC-92 identified the bands 1 885-2 025 MHz and 2 110-2 200 MHz, intended for use on a worldwide basis for IMT-2000, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the satellite component of IMT-2000, in No. **S5.388**;

*b)* that a high altitude platform station (HAPS) is defined in S1.66A as "A station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth";

*c)* that HAPS may offer a new means of providing IMT-2000 services with minimal network build out as it is capable to provide service to a large footprint together with a dense coverage;

*d)* that, in accordance with MOD **S5.388** and Resolution **IMT (WRC-2000)**, administrations may use the bands identified for IMT-2000, including the bands noted herein, for stations of other primary services to which they were allocated;

*e)* that these bands are allocated to the fixed, mobile and mobile-satellite services;

*f)* that ITU-R did not address sharing and coordination between HAPS and some existing systems, such as PCS and MMDS, currently operating in some administrations in the bands 1 885-2 025 MHz and 2 110-2 200 MHz;

*g)* that in accordance with **S5.BBB**, HAPS is allowed to be used as a base station of terrestrial IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2, which are allocated to the fixed, mobile and the mobile-satellite services. The use by high altitude platform stations as an IMT-2000 base station in these bands is based on the equality of rights between all allocated radio services and does not establish priority of assignments in these bands among stations of the primary services to which they are allocated,

*resolves*

1 that administrations wishing to implement HAPS within a terrestrial IMT-2000 system shall give due consideration to the minimum performance characteristics and operational conditions given in Recommendation ITU-R M.[8/115], in particular:

1.1 that for the purpose of protecting certain stations operating in neighbouring administrations from co-channel interference, administrations using HAPS as base stations to IMT-2000 shall use antennae that comply with the following antenna pattern:

$G(\psi) = G_m - 3(\psi/\psi_b)^2$ dBi for $0 \le \psi \le \psi_1$

$G(\psi) = G_m + L_N$ dBi for $\psi_1 < \psi \le \psi_2$

$G(\psi) = X - 60\log(\psi)$ dBi for $\psi_2 < \psi \le \psi_3$

$G(\psi) = L_F$ dBi for $\psi_3 < \psi \le 90°$

where:

$G(\psi)$: gain at the angle $\psi$ from the main beam direction (dBi)

$G_m$: maximum gain in the main lobe (dBi)

$\psi_b$: one-half of the 3 dB beamwidth in the plane of interest (3 dB below $G_m$) (degrees)

$L_N$: near-in-side-lobe level in dB relative to the peak gain required by the system design, and has a maximum value of –25 dB

$L_F$: $G_m$ - 73 dBi far side lobe level (dBi)

$\psi_1 = \psi_b \sqrt{-L_N / 3}$ degrees

$\psi_2 = 3.745\ \psi_b$ degrees

$X = G_m + L_N + 60\log(\psi_2)$ dB

$\psi_3 = 10^{(X - L_F)/60}$ degrees

The 3 dB beamwidth ($2\psi_b$) is again estimated by:

$(\psi_b)^2 = 7442/(10^{0.1Gm})$ (in degrees$^2$)

where $G_m$ is the peak aperture gain (dBi);

1.2 that a HAPS operating as a base station to provide IMT-2000 shall not exceed a co-channel spectral power flux-density (spfd) level of –121.5 dB (W/(m$^2$/MHz)) on the Earth's surface outside an administration's borders unless agreed otherwise with the affected neighbouring administration, noting that this does not necessarily protect all stations operating in co-channel services;

1.3 that a HAPS operating as a base station to provide IMT-2000, in order to protect mobile earth stations of the satellite component of IMT-2000 from interference, shall not exceed an out-of-band spfd level of –165 dB (W/(m$^2$/4 kHz)) on the Earth's surface in the bands 2 160-2 200 MHz in Region 2 and 2 170-2 200 MHz in Regions 1 and 3;

1.4 that a HAPS operating as a base station to provide IMT-2000, in order to protect fixed stations from interference, shall not exceed an out-of-band spfd level on the Earth's surface in the bands 2 025-2 110 MHz of:

–165 dB(W/(m$^2$/MHz)) for angles of arrival ($\theta$) less than 5° above the horizontal plane;

–165 + 1.75 (θ - 5) dB (W/($m^2$ /MHz)) for angles of arrival between 5° and 25° above the horizontal plane; and

–130 dB(W/($m^2$/MHz)) for angles of arrival between 25° and 90° above the horizontal plane,

*invites ITU-R*

to complete additional studies of HAPS sharing and coordination criteria with, between and into other systems in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 in Region 2, and in adjacent bands,

*further resolves*

that ITU-R should expeditiously complete its studies, and at the next WRC, update ITU regarding HAPS sharing and coordination criteria with, between and into other systems in the bands 1 885-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz in Regions 1 and 3 and 1 885-1 980 MHz and 2 110-2 160 MHz in Region 2, and in adjacent bands.

**Reasons:** Footnote S4.15A limits transmissions to and from HAPS to bands specifically identified in the Table of Frequency Allocations. The addition of S5.BBB to the Table of Frequency Allocations will provide administrations with the option to utilize HAPS for IMT-2000 services within the identified bands subject to the provisions of Resolution HAPS, Resolution IMT and national and international regulatory procedures and provisions.

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